METHOD FOR MINIMIZING TIME CRITICAL TRANSMIT PROCESSING FOR A PERSONAL COMPUTER IMPLEMENTATION OF A WIRELESS LOCAL AREA NETWORK ADAPTER

This invention relates to electronic communications systems and more particularly to a system for enabling a computer to transmit and receive information over a packet based wireless communications link. This invention claims the benefit of priority to U.S. Provisional Patent Application No. 60/383,045 filed May 24, 2002.

BACKGROUND OF THE INVENTION

The host microprocessor of personal computers has been used to provide the signal processing functions required to implement wire line analog communications functions for some time. The MODEM functions required to implement exiting wire line standards were historically implemented in software running on dedicated signal processors on the modem hardware. With the advent of more and more powerful personal computers it became possible to implement much of the processing software on the host processor within the PC. Using the host processor instead of dedicated signal processors greatly reduces the cost of the MODEM hardware. If the host processor is powerful enough, the impact on other application running on the host is relatively small when MODEM processing is performed.

The advent of small low cost radios and small portable notebook computers has spurred the recent growth of wireless local area networks (WLAN). These networks are high bandwidth (>1 Mb/s) half duplex packet networks, which contrast with the wire line networks, which are relatively low bandwidth (<56 kb/s), full duplex, and circuit switched. The same cost savings gained in the wire line network adapters by moving the MODEM functions from dedicated hardware to the PC host processor is theoretically possible with WLAN adapters. However, the bit rates and thus the amount of processing required for WLAN adapters is much higher than that of the wire line adapters. On the surface it would appear that the processing required by the WLAN adapter would make the load on the PC host microprocessor prohibitive.

There are several features of the WLAN waveforms and protocol, which can be exploited to allow the host processor in a PC to perform the MODEM functions without significant impact to other applications running on the host processor. First, the WLAN protocol is half duplex, which dictates the host processor is never required to process both transmit and receive waveforms simultaneously. Second, the WLAN protocol is packet based, which means the host processor is not required to process data in a continuous fashion. Third, since the protocol is packet based, every packet is proceeded by a preamble. The preambles can be used to trigger the host processor to perform MODEM processing only when valid packets arrive at the receiver.

Because the WLAN protocol is half duplex much of the time critical processing required in the implementation is the response to valid received packets with a positive acknowledgement (ACK) or other control message. In hardware implementations, the ACK waveform and other control messages are regenerated each time a valid packet is received or the control message is to be sent. The waveform is regenerated even though much of the waveform samples required to generate an ACK is the same each time a packet is received. Similarly, in the case of other control messages much of the frame format is identical for each of the control messages to be sent and thus can be pre-computed and stored in memory.

SUMMARY OF THE INVENTION

A primary objective of the present invention is to provide a technique for enabling a personal computer to transmit and receive information over a packet based wireless communications link at very low cost by using the personal computers central processing unit (CPU) to perform most of the communications link processing.

A secondary objective is to use the personal computers CPU to provide the processing for the packet based wireless communications link in such a way as to minimize the processing load on the CPU so that it can be used simultaneously for both wireless packet data and other desktop applications.

The present invention utilizes the fact that much of the WLAN control frame formats required in the protocol contain data that does not change or changes very slowly. Because these frame formats contain data that does not change very often, the base band waveform required to send the frame formats does not change. This allows the base band waveform samples to be pre-computed, stored in memory and then sent to the transmitter when needed. By storing the waveform ahead of time, the computations required by the host CPU during the time critical period right after a valid packet reception can be reduced. One such control frame of particular interest is an ACK frame. Upon receipt of a valid data frame, the WLAN protocol requires that an ACK frame be sent within 10-20 microseconds (us). Because of the tight timeline for transmitting the ACK after a valid packet receipt, having the ACK pre-computed and stored in memory allows a software based WLAN adapter to provide the ACK in the necessary timeline.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. **1**. is a top level block diagram of a prior art WLAN adapter.

FIG. **2**. is a block-schematic diagram a WLAN adapter which relies on the central processor unit (CPU) of a personal computer (PC) to perform MODEM and MAC functions.

FIG. **3**. is a diagram of the generic message formats for which the WLAN transmit waveforms can be pre-computed.

FIG. **4**. is a diagram of the Request-to-Send (RTS) control frame format.

FIG. **5**. is a diagram of the Clear-to-Send (CTS) control frame format.

FIG. **6**. is a diagram of the Acknowledge (ACK) control frame format.

FIG. **7**. is a diagram of the PS-Poll control frame format.

FIG. **8**. is a diagram of the CF-End control frame format.

FIG. **9**. is a diagram of the CF-End CF-ACK control frame format.

FIG. **10**. is a block-schematic diagram of the data flow within the software driver to manage the pre-computed waveforms.

DETAILED DESCRIPTION

Before explaining the disclosed embodiment of the present invention in detail it is to be understood that the